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# **AFOSR SPONSORED RESEARCH IN COMBUSTION AND DIAGNOSTICS**

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**SUMMARY/OVERVIEW:** The Air Force Office of Scientific Research (AFOSR) program in combustion and diagnostics currently is focused on five areas of study: high-speed propulsion, turbulent combustion, atomization and sprays, diagnostics, and supercritical fuel behavior. An assessment of major research needs in each of these areas is presented.

## **TECHNICAL DISCUSSION**

AFOSR is the single manager for Air Force basic research, including efforts based on external proposals and in-house work at the Air Force Research Laboratory (AFRL). Combustion and Diagnostics is assigned to the AFOSR Directorate of Aerospace and Materials Sciences along with programs in rocket and space propulsion, fluid and solid mechanics, and structural materials.

Interests of the AFOSR Combustion and Diagnostics subarea are given in the SUMMARY section above. Many achievements can be cited for these interests, yet imposing fundamental research challenges remain. The objective of the program is publications in the refereed scientific literature describing significant new understanding of multiphase turbulent reacting flow. Incremental improvements to existing scientific approaches, hardware development, and computer codes fall outside the scope of this objective.

The Combustion and Diagnostics subarea reflects a new Air Force commitment to support space science and technology. Accordingly, the research in this subarea will address research issues related to chemical propulsion for all Air Force aerospace missions, including combined cycle propulsion for access to space. This program will complement related research activities in space propulsion and energetic materials.

Future airbreathing propulsion systems will require fuels to absorb substantial thermal energy, raising fuel temperatures to supercritical thermodynamic conditions. Understanding and controlling fuel properties at these conditions will be crucial for avoiding thermal degradation and for optimizing subsequent processes within the combustor. Environmental concerns and the availability of petroleum supplies also will contribute to future propulsion system design and operational needs.

In the current fiscal year new research opportunities emerged in two areas: plasma-based ignition and combustion enhancement; and combustion-based approaches for the destruction of chemical and biological agents. Plasma research was supported through one of three AFOSR Theme topics, as announced through Broad Agency Announcement 2001-2. The destruction of chemical and biological agents is being pursued through the STTR program. The research community is encouraged to suggest other new directions for combustion research.

Decisions on support for research proposals are based on scientific opportunities and technology needs. Researchers interested in submitting proposals should contact Dr. Tishkoff for information on time constraints associated with proposal evaluations. Further information on research interests and proposal preparation can be found on the AFOSR web site, <http://www.afosr.af.mil>. The availability of funds places a major constraint on program redirection and growth. Figure 1 shows the recent trend of funding for basic research in combustion and diagnostics from Air Force and DOD sources. Funding in the next fiscal year (FY 2001) is expected to be roughly the same as that for FY 2000. Informal inquiries for new research are encouraged throughout the year. Formal proposals should be submitted by 1 April for peer review by the National Research Council.

The purpose of this abstract has been to communicate AFOSR perceptions of research trends to the university and industrial research communities. However, communication from those communities back to AFOSR also is desirable and essential for creating new research opportunities. Therefore, all proposals and inquiries for fundamental research are encouraged even if the content does not fall within the areas of emphasis described herein. Comments and criticisms of current AFOSR programs also are welcome.

